Inflicted Skin Trauma
Bruises and Burns
Dr. Burke Baird
Evaluating Bruises

- Appearance depends on the amount of blood, how deep it is in the tissues, how long it has been there, what caused it and the pigment level of the skin.

- Amount of energy required to cause bruise depends on how soft, pliable and padded the area is and whether there is underlying bone.

- ie. how much energy is absorbed by the tissues around the blood vessels.
Evaluating Bruises

• There is no way to know how old a bruise is by its colour.

• All those charts in the old textbooks were made up.

• If very deep, may take a few days to become visible.
Considering Abuse with Bruises

• Developmental level is the biggest factor to consider.

• Lots of data support the observation that if an infant has not yet reached the age of cruising, they rarely bruise as a result of their own movements and actions.

• Recent study showed that 25% of infants with unexplained bruising had fractures found on skeletal survey. 28% had occult head injury.
Because the baby couldn’t have caused the bruising him/herself the remaining possibilities are....

- The baby has a clotting disorder
- The baby experienced an accidental trauma. At least one caregiver must know what happened.
- The baby experienced an inflicted injury.
Any bruise (or even a history of bruising), even one, anywhere on a pre-cruising infant without a specifically witnessed, plausible accidental mechanism should be considered possible abuse until proven otherwise.

A full medical assessment is required.

Immediately

If the clotting studies are normal, worry more about abuse rather than less.
Location, location, location

Mobile children tend to get accidental bruises on:

- Forward facing surfaces (foreheads, elbows, shins and knees)
- Surfaces with superficial underlying bone (vertebral spines, ribs, shoulder blades, bony edge of pelvis)
Other stuff about accidental bruises

• Usually single rather than multiple or clustered.

• Usually round, rather than shaped or patterned.

• Typically small rather than large/extensive.
Suspicious bruising

- Large/extensive without a viable accidental mechanism.
- Soft, padded area, particularly on a posterior surface.
- Concave surfaces ie neck/throat/groin.
- Tissue that takes a lot of energy to bruise - external ear, abdomen, groin/buttocks.
- Shape, pattern, outline, regularity to the appearance.
Suspicious bruises

- Bilateral/symmetry

- Significant bruising reportedly inflicted by a toddler/preschooler.

- Large number - There’s no upper limit of normal, but most normal kids have relatively few accidental bruises.

- Story offered does not make sense, regardless of the nature of the injury.

- Beware of speculations masquerading as observations.
Issues with the Medical Assessment

• Is it a bruise?

• Is the child prone to easy bruising/bleeding?
Things mistaken for bruising.

- Pigmentation - deep blue nevus (Mongolian Spot), post-inflammatory hyperpigmentation
- Vascular birthmarks
- Vasculitis
- Infection
- Dirt, magic marker, blue indicator chemical from the child’s diaper etc.
Ruling out a coagulopathy

History

• Gender

• Previous clotting challenges - circumcision, umbilical stump, tooth eruption, immunization, surgery

• Family history

• Medications

• Evidence of collagen disorder
Coagulopathy?

• Don’t bother asking if the child (or parent) bruises easily. For some reason that I don’t understand, most people say yes.

• It’s more helpful to ask if anyone in the family has been diagnosed with (or is suspected of having) a bleeding disorder.
<table>
<thead>
<tr>
<th>Bleeding disorder</th>
<th>Incidence</th>
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<tbody>
<tr>
<td>von Willebrand disease</td>
<td>1 in 100</td>
</tr>
<tr>
<td>Factor VIII deficiency</td>
<td>1 in 10,000</td>
</tr>
<tr>
<td>Factor IX deficiency</td>
<td>1 in 50,000</td>
</tr>
<tr>
<td>Afibrinogenaemia</td>
<td>1 in 1,000,000 (homozygous state)</td>
</tr>
<tr>
<td>Prothrombin deficiency</td>
<td>1 in 2,000,000 (homozygous state)</td>
</tr>
<tr>
<td>Factor V deficiency</td>
<td>1 in 1,000,000 (homozygous state)</td>
</tr>
<tr>
<td>Factor VII deficiency</td>
<td>1 in 300,000 to 1 in 500,000 (homozygous state)</td>
</tr>
<tr>
<td>Factor X deficiency</td>
<td>1 in 1,000,000 (homozygous state)</td>
</tr>
<tr>
<td>Factor XI deficiency</td>
<td>1 in 1,000,000 (homozygous state)</td>
</tr>
<tr>
<td>Deficiency of factors II, VII, IX, X</td>
<td>&lt;20 kindreds worldwide (homozygous state)</td>
</tr>
<tr>
<td>Factor XIII deficiency</td>
<td>1 in 1,000,000 (homozygous state)</td>
</tr>
<tr>
<td>Alpha-2-antiplasmin deficiency</td>
<td>Extremely rare</td>
</tr>
<tr>
<td>Plasminogen activator inhibitor-1 deficiency</td>
<td>Extremely rare</td>
</tr>
<tr>
<td>Disorders of platelet function and inherited thrombocytopenias</td>
<td>For details see Bolton-Maggs et al&lt;sup&gt;6&lt;/sup&gt;</td>
</tr>
<tr>
<td>Bernard–Soulier syndrome</td>
<td>&lt;1,000 cases worldwide</td>
</tr>
<tr>
<td>Glanzmann thrombasthenia</td>
<td>&lt;1,000 cases worldwide</td>
</tr>
</tbody>
</table>
Who to work up?

• If the history is suggestive of a disorder.

• Infants (pre-cruisers).

• Non-patterned bruises in unusual locations.

• Intracranial hemorrhages

• If you are making a strong statement about likely inflicted injury and its therefore really, really important not to get it wrong.
What child may not require a coagulation work-up?

- Single (or relatively few) highly suspicious/patterned bruises ie. ear bruises, belt mark etc.
- Other, obviously inflicted injury - metaphyseal fracture, abdominal trauma.
- Perpetrator confession
Tests to do (CPS guideline)

- CBC, INR, aPTT
- Von Willebrand assay and blood group.
- Fibrinogen
- Factor VIII, Factor IX
- Liver and renal function
More extensive testing if needed

• Intracranial hemorrhage/retinal hemorrhage

• Anything abnormal on the initial testing
Extended work-up for intracranial hemorrhage

- Factor XIII
- Platelet function assay
Haematology Consult?

• If initial work-up points to a bleeding disorder.

• If you think you’ve completely ruled out a bleeding disorder but it’s a really controversial case and you need someone to agree with you (or correct you because you’ve missed something)
Inflicted Childhood Burns

Sorting out what happened
General info

• Depth/severity depends on temperature of the offending object(s) and time in contact with the skin.

• Appearance also depends on movement/flow of the object or of the child.

• Presence/absence of clothing and body position will affect the depth and appearance.
Assessing a Suspicious Burn

Very similar approach to assessing bruises or other skin trauma.

It's mostly about the story of how it happened and whether it is plausible or not.

- Is the child capable of doing what is reported?
- What was the temperature of the burning agent?
- How long was the agent in contact with the skin?
Assessing a Suspicious Burn

Appearance of the burn

- Accidental burns usually have irregular shapes, splash patterns and varying burn depths and evidence that the child moved.

- Inflicted burns are often shaped, with sharply demarcated edges and relatively uniform burn depths
Investigating a Burn Case

- Scene photographs and re-enactment are extremely helpful with suspicious burns.
- Sometimes an object that matches the burn is found.
- Check thermostat on the hot water tank.
- Measure temperature of water at the faucet in question for suspected immersion burns.
- Assess whether what is reported is physically possible ie. can you reach the hot water tap if you’re standing on the toilet seat?
A Surprising Fact

• Some young children, rather than withdrawing from a hot water stream/immersion will instead “freeze” in place.

• This should be kept in mind when asserting what a child “would/should” do in that circumstance.
Delay in seeking medical care for a burn is very common, which is even more disturbing when you consider how much a burn hurts and how important it is to treat them early to prevent infection and other complications.
Burn Depth/Severity
For illustrative purposes only. This was done on the skin of adult prisoners.